...ports. | separate | from 1954.

DR R. T. C. PRATT

Dr R. A. Henson writes:

The recent death of Dr. R. T. C. Pratt a year after his retirement has removed a unique figure from the worlds of neurology and psychiatry. He developed diabetes mellitus while an undergraduate at Oxford, where he was placed in the first class, and decided to pursue medicine on the advice of his tutor.

Qualifying BM B.Ch. in 1943, he obtained his membership of the Royal College of Physicians in 1944. Subsequently he proceeded to the DM in 1950, and was elected FRCP in 1964 and FRC Psych. in 1972. After training in general medicine and neurology at the Middlesex Hospital, Dick decided to become a psychiatrist and was appointed Consultant in Psychological Medicine to the National Hospitals for Nervous Diseases (Queen Square and Maida Vale) in 1954. He had been awarded the Gaskell Gold Medal in Psychiatry in 1953.

Pratt's early work lay in the neurological field and led to several useful publications, but he will be best remembered for his monograph "The Genetics of Neurological Disorders," published in 1967. This contribution to the neurological literature was marked by its thorough comprehensive nature and a concise unassuming style, characteristic of the man.

On the psychiatric side he was naturally concerned with the psychiatric disorders associated with organic brain disease and the psychological defects arising from localized lesions of the brain. Yet his fine mind and wide knowledge were most evident in discussions on the research of others and in seminars for small groups of colleagues and postgraduate students. His opinion was valued by those working in fields far removed from his own, for he was an excellent scientist.

Dick was afflicted for years by painful and artially disabling neurological complications of his diabetes. He refused to acknowledge or discuss his sufferings, working on despite them. His courage was remarkable, and so were his modesty and gentleness. Unfortunately his personal plans for studies on the psychology of music will remain unfulfilled.

"The instrument may be furnished with a graduated quadrant for the purpose of adapting it to any latitude; but if it be intended to be fixed in any locality, it may be permanently adjusted to the proper polar elevation and the expense of the graduated quadrant be saved: a spirit-level will be useful to adjust it accurately. The instrument might be set to its proper azimuth by the sun's shadow at noon, or by means of a declination needle; but an observation with the instrument itself may be more readily employed for this purpose. Ascertain the true solar time by means of a good watch and a time equation table, set the hand of the polar clock to correspond thereto, and turn the vertical pillar on its axis until the colours of the selenite star entirely disappear. The instrument then will be properly adjusted.

"The advantages a polar clock possesses over a sun-dial are,—1st. The polar clock being constantly directed to the same point of the sky, there is no locality in which it cannot be employed, whereas, in order that the indications of a sun-dial should be observed during the whole day, no obstacle must exist at any time between the dial and the places of the sun, and it therefore cannot be applied in any confined situation. The polar clock is consequently applicable in places where a sun-dial would be of no avail; on the north side of a mountain or of a lofty building for instance. 2ndly. It will continue to indicate the time after sunset and before sunrise; in fact, so long as any portion of the rays of the sun are reflected from the atmosphere. 3rdly. It will also indicate the time, but with less accuracy, when the sky is overcast, if the clouds do not exceed a certain density.

"The plane of polarization of the north pole of the sky moves in the opposite direction to that of the hand of a watch; it is more convenient therefore to have the hours graduated on the lower semicircle, for the figures will then be read in their direct order, whereas they would be read backwards on an upper semicircle. In the southern hemisphere the upper semicircle should be employed, for the plane of polarization of the south pole of the sky changes in the *same* direction as the hand of a watch. If both the upper and lower semicircles be graduated, the same instrument will serve equally for both hemispheres."

Several other forms of the polar clock were then described; the following is a description of one among them, which, though much less accurate in its indications than the preceding, beautifully illustrates the principle.

On a plate of glass twenty-five films of selenite of equal thickness are arranged at equal distances radially in a semicircle; they are placed so that the line bisecting the principal sections of the films shall correspond with the radii respectively, and figures corresponding to the hours are painted above each film in regular order. This plate of glass is fixed in a frame so that its plane is inclined to the horizon 38° 32′, the complement of the polar elevation; the light passing perpendicularly through this plate falls at the polarizing angle 56° 45′ on a reflector of black glass, which is inclined 18° 13′ to the horizon. This apparatus being properly adjusted, that is so that the glass dial-plate shall be perpendicular to the polar axis of the earth, the following will be the effects when presented towards an unclouded sky. At all times of the day the radii will appear of various shades of two complementary colours, which we will assume to be red and green, and the hour is indicated by the figure placed opposite the radius which contains the most red; the half-hour is indicated by the equality of two adjacent tints.

On rendering the Electric Telegraph subservient to Meteorological Research. *By* JOHN BALL, *M.R.I.A.*

What is popularly termed the weather is a general expression for the physical condition of the atmosphere with reference to heat, pressure, moisture, and the velocity and direction of its motion. Two classes of causes determine these conditions at any given point of the earth's surface. The first class may for short periods of time be considered as constants, depending on the position of the point of observation on the globe and the physical conformation of the adjoining district. The second class, upon which the proverbial uncertainty of the weather depends, arise from the influence exerted by each portion of the atmosphere upon those surrounding it, by virtue of which a disturbance of equilibrium at any one point is rapidly propagated in all directions. In common language this is expressed by saying that

the direction of the wind is at once the cause and the indication of changes of the weather. However far we may be from a general solution of the problem of atmospheric disturbances, meteorologists have made considerable progress in tracing the connection between successive states of the weather, owing to the mutual influence of contiguous portions of the atmosphere. These cases have been studied *à posteriori*, comparing the known results with observations extending over considerable areas. Now that we have the means of receiving information in an indefinitely short space of time by the Electric Telegraph, these problems, under favourable circumstances, may be studied *à priori*. In London we may receive instantaneous intelligence of the condition of the atmosphere, as to the five above-mentioned elements, from nearly all the extremities of Great Britain. With a delay of about four hours we can have similar intelligence from the western part of Ireland, and with a still shorter delay our communications may extend to the centre of France, the banks of the Rhine, and even to the frontiers of Hungary and Poland.

I do not pretend to say that with such elements for calculation we should at once be enabled to predict changes in the weather with absolute certainty. It would require some time to eliminate the action of accidental and local causes at particular stations; but there is no reason to doubt that in a short time the determinations thus arrived at would possess a high degree of probability. The ordinary rate at which atmospheric disturbances are propagated does not seem to exceed twenty miles per hour; so that with a circle of stations extending about 500 miles in each direction, we should in almost all cases be enabled to calculate on the state of the weather for twenty-four hours in advance.

Description of a New Instrument for observing the Apparent Positions of Meteors. By the REV. J. CHALLIS, *M.A., F.R.S., Plumian Professor of Astronomy at the University of Cambridge (in a Letter to the Assistant General Secretary).*

Having had occasion to make use of observations of auroral arches and coronæ, and other meteoric phænomena, I have seen the desirableness of noting the positions by instrumental means, rather than trusting to vague estimation and reference to stars. Accordingly I have had a brass instrument constructed for me by Mr. Simms, Fleet Street, London, which may possibly answer this purpose in some degree. I propose to call it a *Meteoroscope*. It is in principle an altitude and azimuth instrument, in the form of a theodolite, having a horizontal circle graduated from 0° to 360°, and a vertical arc graduated from 0° to 120°, each about 4 inches in radius. The vertical arc is readily moveable about a vertical axis passing through the centre of the horizontal circle, and instead of having a telescope, which would be inapplicable to the class of observations proposed to be taken, it carries a bar 18 inches long, having a small rectangular plate at each end. One of these plates is perforated by a circular hole one-sixth of an inch in diameter, through which the object is viewed, and the other has its edges vertical and horizontal, the observation of altitude being made by bringing the horizontal edge, and the observation of azimuth by bringing the vertical edge, to bisect the object. Both observations are made at the same time by placing the angular point in apparent coincidence with the object. The eyelet-hole should not be less than the pupil of the eye when dilated, that there may be as little loss of light as possible. No parallax of serious amount will arise from the size of the hole, as it is always easy to judge when the centre of the pupil and that of the hole are nearly coincident. The bar is moveable about a horizontal axis passing through the centre, and perpendicular to the plane of the vertical arc, and is carried by a radius so that the direction of its length is a tangent to the arc. The direction of the radius is somewhat oblique to that of the bar, in order that the line of collimation may pass the zenith about 20° when the radius is brought to a horizontal position. For the same reason the centre of motion of the bar is elevated about an inch and a half above the plane of the azimuth circle. For the purpose of viewing conveniently an object near the zenith, the plate at the eye-end of the bar has a small silvered glass reflector inclined at an angle of 45° to the plane of the plate, and adjustible by a screw. The object is seen by reflexion in a direction perpendicular to the line of collimation, through another

$n x = \lambda$

$(n_1 - n_2) t = \lambda$

$t = \dfrac{\lambda}{n_1 - n_2}$

λ 10^{-3}

.001 mm

given time, proportional to the square of the intensity of the current. For, whatever be the actual source of the galvanism, an equivalent current might be produced by the motion of a magnetic body in the neighbourhood of the closed wire. If now, other circumstances remaining the same, the intensity of the magnetism in the influencing body be altered in any ratio, the intensity of the induced current must be proportionately changed; hence the amount of work spent in the motion, as it depends on the mutual influence of the magnet and the induced current, is altered in the duplicate ratio of that in which the current is altered; and therefore the amount of mechanical effect lost in the wire, being equivalent to the work spent in the motion, must be proportional to the square of the intensity of the current. Hence if i denote the intensity of a current existing in a closed conductor, the amount of work lost by its existence for an interval of time dt, so small that the intensity of the current remains sensibly constant during it, will be $k \cdot i^2 \cdot dt$; where k is a certain constant depending on the resistance of the complete wire.

Let us now suppose this current to be actually produced by induction in the wire, under the influence of a magnetic body in a state of relative motion. The entire mutual force between the magnetic and the galvanic wire may, according to Ampère's theory, be expressed by means of the differential coefficients of a certain "force function." This function, which may be denoted by U, will be a quantity depending solely on the form and position of the wire at any instant, and on the magnetism of the influencing body. During the very small time dt, let U change from U to U$+d$U, by the relative motion which takes place during that interval. Then $i\,d\mathrm{U}$ will be the amount of work spent in sustaining the motion; but the mechanical effect lost in the wire during the same interval is equal to $k\,i^2\,dt$; and therefore we must have

$$i\,d\mathrm{U}=k\,i^2\,dt.$$

Hence, dividing both members by $k\,i\,dt$, we deduce

$$i=\frac{1}{k}\cdot\frac{d\mathrm{U}}{dt},$$

which expresses the theorem of Neumann, the subject of the present communication. We may enunciate the result in general language thus:—

When a current is induced in a closed wire by a magnet in relative motion, the intensity of the current produced is proportional to the actual rate of variation of the "force function" by the differential coefficients of which the mutual action between the magnet and the wire would be represented if the intensity of the current in the wire were unity.

On a means of determining the apparent Solar Time by the Diurnal Changes of the Plane of Polarization at the North Pole of the Sky. *By* Professor WHEATSTONE, *F.R.S.*

"A short time after the important discovery by Malus of the polarization of light by reflexion, it was ascertained by Arago that the light reflected from different parts of the sky was polarized. The observation was made in clear weather with the aid of a thin film of mica and a prism of Iceland spar; he saw that the two images projected on the sky were in general of dissimilar colours, which appeared to vary in intensity with the hour of the day and with the position, in relation to the sun, of the part of the sky from which the rays fell upon the film. The first attempt to assign a law to the phænomena of atmospheric polarization was made by Professor Quetelet of Brussels in 1825 in the following terms:—'If the observer consider himself as placed in the centre of a sphere of which the sun occupies one of the poles the polarization is at its maximum at the different points of the equator of this sphere, and goes on diminishing in the ratio of the squares of the sines unto the poles where it is at zero.' This law would be true did the reflected light proceeding from the part of the sky regarded arise solely from the direct light of the sun sent to that part; but other secondary reflexions occur which complicate the result and give rise to the neutral points since discovered by Arago, Babinet and Brewster. But for the purpose of explaining the principle of the instrument now submitted to the examination of the Section, we need not take into consideration the intensity of the polarization of the part of the sky to which it is directed; the plane of polarization for the time being is the only thing we need concern ourselves about, and a very simple expression, stated first I believe by M. Babinet, defines the position of this plane for any given point of the sky; it is this: 'For a given point of the atmosphere the plane of polarization of the portion of polarized light which it sends to the eye coincides with the plane which passes through this point, the eye of the observer and the sun.' The truth of this law may be easily demonstrated without any refined apparatus in the following manner:—Let the observer be provided with a Nicol's prism and a plate of Iceland spar cut perpendicularly to the axis, and stand with his back towards the sun; keeping the diagonal of the prism always in the same vertical plane, let him direct it successively to every point of the sky within that plane; the intensity of the polarization indicated by the brightness of the coloured image will vary very considerably at these different points, but the plane of polarization indicated by the upright position of the black or white cross, as the case may be, will remain unchanged. I leave out of consideration for the present the inversion of the plane of polarization observed occasionally near the horizon below the neutral point.

"If we direct our analysing apparatus to the zenith during the whole day, the change in the plane of polarization of that point of the sky will correspond with the azimuths of the sun. Let us now turn our attention to the north pole of the sky: as the sun in its apparent daily course moves equably in a circle round this pole, it is obvious that the planes of polarization at the point in question change exactly as the position of the hour-circles do. The position of the plane of polarization of the north pole of the sky will at any period of the day therefore indicate the apparent or true solar time. The point of intersection of the hour-circles, or the north pole of the sky, corresponds on only two days of the year with the maximum intensity of polarization; these days are the equinoxes; on all other days the points of maximum polarization of the respective hour-circles describe a circle round the point of intersection; but the angular distance thereof, which is greatest at the solstices, never exceeding 23° 28′, the polarization has always sufficient intensity to exhibit brilliant colours in films of selenite, &c.

"These points being premised, I proceed to describe the new instrument, which I have called the Polar Clock or Dial. It is thus constructed. At the extremity of a vertical pillar is fixed, within a brass ring, a glass disc, so inclined that its plane is perpendicular to the polar axis of the earth. On the lower half of this disc is a graduated semicircle divided into twelve parts (each of which is again subdivided into five or ten parts), and against the divisions the hours of the day are marked, commencing and terminating with VI. Within the fixed brass ring containing the glass dial-plate, the broad end of a conical tube is so fitted that it freely moves round its own axis; this broad end is closed by another glass disc, in the centre of which is a small star or other figure, formed of thin films of selenite, exhibiting when examined with polarized light strongly contrasting colours; and a hand is painted in such a position as to be a prolongation of one of the principal sections of the crystalline films. At the smaller end of the conical tube a Nicol's prism is fixed so that either of its diagonals shall be 45° from the principal section of the selenite films. The instrument being so fixed that the axis of the conical tube shall coincide with the polar axis of the earth, and the eye of the observer being placed to the Nicol's prism, it will be remarked that the selenite star will in general be richly coloured, but as the tube is turned on its axis the colours will vary in intensity, and in two positions will entirely disappear. In one of these positions a small circular disc in the centre of the star will be a certain colour (red for instance), while in the other position it will exhibit the complementary colour. This effect is obtained by placing the principal section of the small central disc 22½° from that of the other films of selenite which form the star. The rule to ascertain the time by this instrument is as follows: the tube must be turned round by the hand of the observer until the coloured star entirely disappears while the disc in the centre remains red; the hand will then point accurately to the hour. The accuracy with which the solar time may be indicated by this means will depend on the exactness with which the plane of polarization can be determined; one degree of change in the plane corresponds with four minutes of solar time.

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20 July 79

Dear Dr Redhead,

Many thanks again for your help with my problems. I wish I had had some proper instruction when I was 15 — I think the Balliol undergraduates are very lucky.

I hope Mrs Redhead and the children are well.

Yours sincerely

R Pratt

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6 July 79

Dear Dr Redhead,

I enclose prescription. I am glad you are well – if you do go through a sticky patch please get in touch.

Would you mind looking at the enclosed if you have time?

Can you ~~put into~~ explain in modern terms the "arithmetical" section; and if possible explain the way that the quadrant works (e.g. why and what is happening e.g. on page 6 where he takes the sum and

the difference)

Thank you for recommending the book on History of Maths. I am dipping at the moment into Neugebauer A History of Ancient Mathematical Astronomy, tho' I am far from understanding the difficult parts.

With kind regards

Yours sincerely

R Pratt

$\cos a = \cos b \cos c + \operatorname{sen} b \operatorname{sen} c \cos \alpha$

$a^2 = b^2 + c^2 - 2bc \cos \alpha$

$$\cos \alpha = \frac{\cos a - \cos b \cos c}{\operatorname{sen} b \operatorname{sen} c}$$

obs: $\cos b \cos c = \frac{1}{2}(\cos(b+c) + \cos(b-c))$

$\operatorname{sen} b \operatorname{sen} c = \frac{1}{2}(\cos b - c - \cos b + c)$

$$2\cos^2 \alpha/2 = 1 - \frac{\cos a - \cos b \cos c}{\operatorname{sen} b \operatorname{sen} c}$$

$\cos A - \cos B = 2 \operatorname{sen} \frac{A+B}{2} \operatorname{sen} \frac{B-A}{2}$

$$= \frac{\cos a - (\cos b \cos c - \operatorname{sen} b \operatorname{sen} c)}{\operatorname{sen} b \operatorname{sen} c}$$

$\cos(b+c) = \cos b \cos c - \operatorname{sen} b \operatorname{sen} c$

$$= \frac{\cos a - \cos(b+c)}{\operatorname{sen} b \operatorname{sen} c} = \frac{2 \operatorname{sen} \frac{a+b+c}{2} \operatorname{sen} \frac{b+c-a}{2}}{\operatorname{sen} b \operatorname{sen} c}$$

$$\cos \alpha - 1 = \frac{2 \operatorname{sen} \frac{a+b+c}{2} \operatorname{sen} \frac{a-b-c}{2}}{\operatorname{sen} b \operatorname{sen} c}$$

$\frac{1}{\operatorname{sen} b} = \frac{\operatorname{sen} c}{x}$

$\operatorname{sen}^2 \alpha/2 = \operatorname{sen} y$

$\frac{1 + \operatorname{sen} y}{2} = \cos \frac{\alpha}{2}$

$\frac{1 - \cos \alpha}{2} = \operatorname{sen} y$

$\cos \alpha = 1 - 2 \operatorname{sen} y$

$= \frac{1 + \operatorname{sen}^2 \alpha/2}{2}$

$=$

$\operatorname{sen}^2 \alpha/2 = \operatorname{sen} y$

$\frac{1 - \cos \alpha}{2} = \operatorname{sen} y$

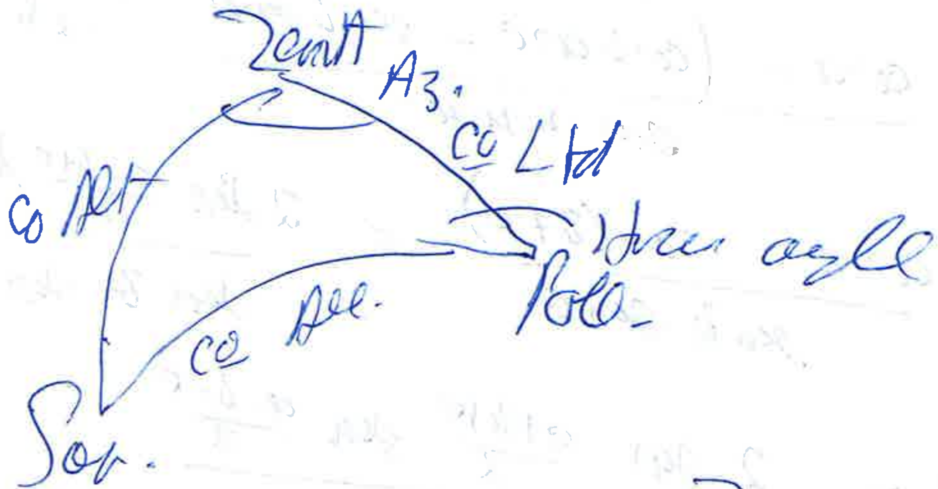
$\cos \frac{\alpha}{2} = 1 - 2 \operatorname{sen}$

$\frac{1 + \operatorname{sen}^2 \alpha/2}{2} = \cos \alpha/2$

$\operatorname{sen}^2 \alpha/2 = 2 \cos \alpha/2 - 1$

Aflx

$$\cos A = \frac{(\cos a - \cos(L+e)) + (\cos a - \cos(L-e))}{\cos(L-e) - \cos(L+e)}$$



$$= 2\left[\frac{\cos a - \cos(L+e)}{\cos(L-e) - \cos(L+e)}\right] - 1$$

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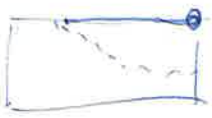
23 Jan

Dear Mr Redhead,

I sent the prescription off & hope it arrived safely.

I think you considered my ~~problem~~ difficulty about spherical trig to be rendered more difficult when I asked you to turn the sun-dial triangle into plane trig. But you will see from the enclosed that I have illustrious predecessors in Vitruvius & Ptolemy. The photostat is from a book called Greek & Roman Sundials by Sharon Gibbs (it seems they were mainly conical

  & the island of Delos specialized

in their manufacture.)

Ptolemy's analemma is also considered to be an early practical example of nomography before the formalisation of this subspecialty

— there is a paper on this by Luckey, Astronomische Nachrichten no. 5498

— & another type of pocket sundial circa 1450 is dealt with in Annales de la Soc. scient. de Bruxelles vol jubilaire 1926. pp 55-66 by OCAGNE: "Le calcul nomographique avant la nomographie"

I have photostats of those if they would interest you (or your pupils). Could you return the photostat some time (no hurry)

I hope the family are well.

Yours sincerely

R Pratt

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5 Oct 77

Dear Dr Redhead,

May I ask for your help again: The enclosed paper by Wheatstone (whose name will bring back memories of your early days in physics) is from the BA meeting of 1848.

I would like to construct the dial mentioned at the end of his paper. Could you explain to me how it works (+ how the angle 18° 13' (18+38=56') is obtained). To construct it, would I need films of selenite (does this mean a thin section), or are there more modern materials. For example could one make something like this with a

polaroid sheet and photosensitive glass. And finally where might I get such materials? MICA

Also do you know of a simple introduction to conic sections — the more elementary it is, the better. (e.g. even something like Hogben's Mathematics for the Million, but Hogben doesn't mention them). GREEN

I hope Mrs Redhead is better again, & that the children are well.

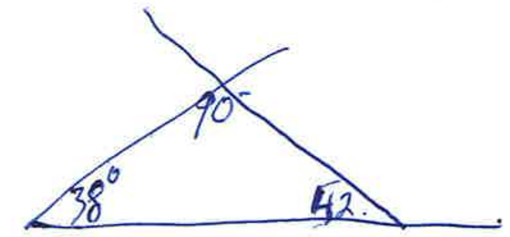
With many thanks

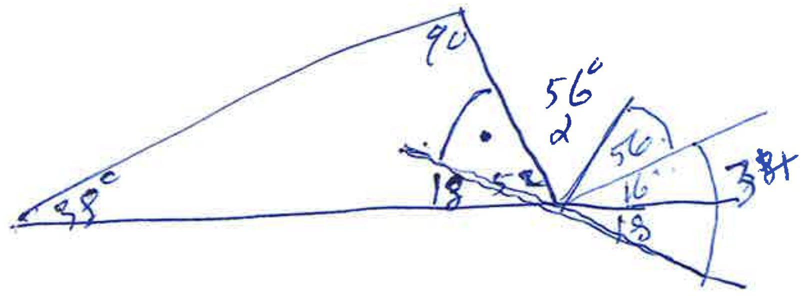
Yours sincerely

R Pratt

P.S. and of course I hope you are keeping well.

42





$90° - 52$

$\alpha = 90° - (52 - 18)$

$= 90 - (90 - 38 - 18)$

$38 + 18 = 56$

$90 - 38°32'$

$51°28$

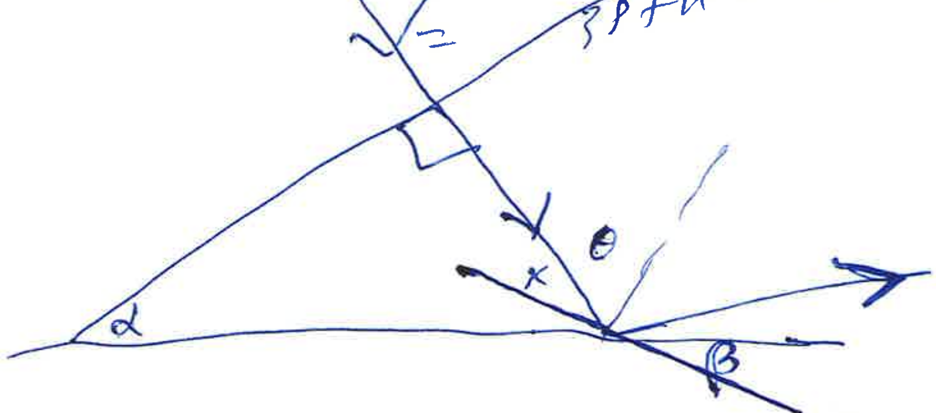
60

18.13

33.15

56.45

0.0



$\theta = 90 - x = 90 - (90 - \alpha - \beta) = (\alpha + \beta)$

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16 Nov

Dear Dr Rodhead,

Apologies for the delay in thanking you for all the trouble you took. I delayed writing so that I could report my progress — I can't say I have conquered either conic sections or polarisation yet, but I am making some progress! The news about Oxford is very good — I think they are very lucky indeed to have you.

I hope the news is

good of your wife, & that the children prosper.

Yours sincerely

R Pratt.

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9 July 76

Dear Mr Redhead,

In the past you produced such clear & succinct explanations of the nature of zero and the formula for quadratics that I am troubling you again.

My problem is how to understand how he gets the formula for the angle H, and to understand it either directly or by plane trigonometry.

I think the text is clear, and I understand that if I am facing a declining wall the sun is perpendicular to the wall ('s plane extended) at an hour-angle corresponding to the declination.

What I can't visualize is the derivation of the angle at which the sun shines directly down the triangular shadow-caster x, x pointing at the pole (θ = complement of latitude). I suspect

the answer lies in the meeting of two planes, but how they meet and where I can't get.

I have pondered on this for about a year, but can get no further.

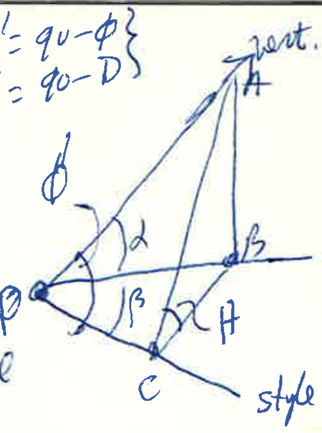
I hope you, Mrs Redhead and the children are well.

Yours sincerely

R Pratt.

$D' = 90 - D$.

$\phi' = 90 - \phi$ }
$D' = 90 - D$ }



$\tan H = \tan\alpha / \sin\beta$

$\cot D' = \tan\alpha / \sin\beta \cdot \sin\phi = \tan H \sin\phi$

$\tan D' = \dfrac{\tan\beta}{\sin\alpha}$

AC = meridional plane
OAB = plane of decl.
OBC = plane thro' style ⊥ decl.

$\therefore \dfrac{\sin\alpha}{\tan\beta} = \dfrac{\tan\alpha}{\sin\beta} \cdot \sin\phi$

$\sin\phi = \cancel{\tan H} \quad \cancel{\dfrac{\cot D'}{\tan H}} \quad \dfrac{\cot D'}{\tan H} = \dfrac{\cot H}{\tan D'}$,

$\tan H \sin\phi = \dfrac{\tan\alpha}{\sin\beta} = \tan D$

$\tan\alpha / \sin\beta = \dfrac{AB}{OB} / BC/OB = \tan H$ ✓

and $\cancel{\cot} \, H = \dfrac{\tan\beta}{\sin\alpha} \cdot \cancel{\cos}\phi$ ✓

$= \dfrac{BC}{OC} \cdot \dfrac{OA}{\cancel{OA}AB} \quad \dfrac{AC}{\cancel{OA}} \dfrac{OC}{OA} = \dfrac{BC}{AB} = \cot H$

$\cot H = \dfrac{\tan\beta}{\sin\alpha} \cdot \cos\phi$, $\tan H = \dfrac{\tan\alpha}{\sin\beta}$.

$\tan D' = \dfrac{\tan\beta}{\sin\alpha}$, ✓

Hence. $\dfrac{\sin\alpha}{\tan\beta} / \cos\phi = \dfrac{\tan\alpha}{\sin\beta}$ or $\cos\phi = \dfrac{\cancel{\quad}}{\cos\alpha \cos\beta}$ or $\cos\alpha \cos\beta \cos\phi = 1$

i.e. $\dfrac{OB}{OA} \cdot \dfrac{OC}{OB} \cdot = \dfrac{OC}{OA}$

PRATT

1 CHURTON PLACE

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